PRODUCTION OF PHYTIN , PHYTIC ACID AND MYO-INOSITOL FROM PALM KERNEL CAKE

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INTRODUCTION

By-products of the food and milling industries are mostly used as animal feeds and this is typically so with the case of palm kernel cake obtained from the oil palm industry in Malaysia. Rubberseed cake can also be used as animal feed but due to the difficulty in collecting the seeds from the rubber estates, its usefulness has never been fully exploited. Further applications of the by-products of the food and milling industries would elevate the status of these industries and possibly initiate a supporting industry.

Myo-inositol from palm kernel cake.

Phytic acid is known to be the major component of all plant seeds and many cereals (*Table 1*) and typically accounting for 50%-90% of the total phosphorus. It usually occurs as a mixed calcium-magnesium-potassium salt (phytin) in discrete regions of the seeds. Phytic acid may serve several important physiological functions during dormancy and germination, such as storage of phosporus, high-energy phosphoryl groups, cations and as cell wall percusor. Further, phytic acid is believed to protect seeds against oxidative damage during storage. The unique structure of phytic acid, *Figure 1*, suggests tremendous chelating potential. This highly useful compound has been extensively discussed in several reviews (Graf, 1983; Erdman, 1979; Graf, 1986; Yaacob *et al.*, 1989).

Uses of phytic acid and phytate salts are many, and three most important examples are: as an antioxidant, anticorrosion and as a chelating agent. Phytic acid prevents autooxidation and hydrolysis of fats and oils and stabilizes lipid containing foods against rancidity. It also preserves meat, bread, salad, fish, cooked noodles and prevents darkening of processed foods containing eggs on heating. Garlic can also be deodorized by the use of phytic acid. Neither phytic acid nor any of its metabolites are toxic or highly reactive, making it more favourable than other preservatives currently on the market, *e.g.*, nitrite or metabisulphite.

The tremendous chelating potential of phytic acid makes it an excellent anti-corrosion and scratch resistance and prevention towards blackening by sulphur on tin plates and cans. Paint additives containing phytic acid produces film of improved hardness, adhesion and corrosion resistance. Its chelating property is used in formulations to treat wastewater from meat – processing plants to remove blood, as a precipitating agent for the extraction and separation of rare earth metals from ores and as a cleaning solution for toilets to chelate urinary calcium.

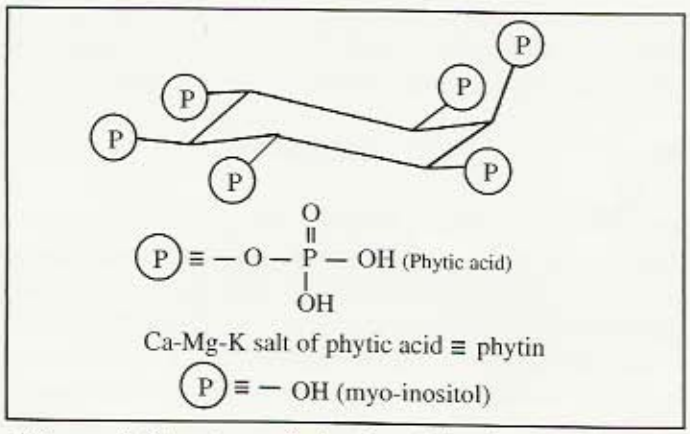

Figure 1. Structure of phytic acid and myo-inositol.

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TABLE 1. PHYTIC ACID CONTENT OF SELECTED SEEDS

Sample (Graf, 1983)	Phytic acid (% w/w)
Waldron wheat	1.1
Waldron wheat bran	4.8
Wheat germ	3.9
Corn	0.9
Corn bran	0
Corn germ	6.4
Soya beans	1.4
Soya flakes	1.8
Soya hulls	0.1
Dehulled sesame seeds	5.3
Peanuts	1.9
Dehydrated peas	0.9
Lima beans	2.5
Barley	1.0
Oats	0.8
Wild rice	2.2
Sunflower seeds	1.9
Palm kernel cake	1.2 - 1.4
Rubberseed	0.3 - 0.5
Local rice bran	1.2 - 1.5

Another specialty chemical that can be produced from phytin is myo-inositol, a GRAS compound, normally referred to as a Vitamin B supplement in the pharmaceutical industry. The compound is used as a food additive in infant formulae, in special dietary foods as a nutritional supplement, in health and isotonic drinks (such as Livita, *etc.*), cough syrups (such as Lysine B12, *etc.*), cosmetic ingredients (such as anti-dandruff shampoos, *etc.*) and pharmaceutical preparations.

PHYTIN FROM PALM KERNEL CAKE

Phytin can be extracted from palm kernel cake by extraction of the defatted sample with a mineral acid followed by precipitation of the acidified phytin filtrate with a base and further purification by standard chemical techniques. The phytin thus obtained is a white powder and purification by ion-exchange chromatography gives aqueous phytic acid. High pressure hydrolysis of phytin produces myo-inositol on a quantitative basis.

Two processes have been patented by PORIM for the production of phytin, phytic acid and myo-inositol using palm kernel cake or palm kernel pellet as the feed materials (Yaacob, 1995; Yaacob, 1996). The two processes are summarized in *Figure 2*.

CONCLUSION

In conclusion, the technology for producing phytin, phytic acid and myo-inositol from palm kernel cake is available. The production of the three speciality chemicals from palm kernel cake or palm kernel pellet – an abundant and cheap by-product of the oil palm industry, makes it possible for SMIs in Malaysia to enter into the speciality and fine chemical industry, which at present is dominated by European, North American and Japanese industries.

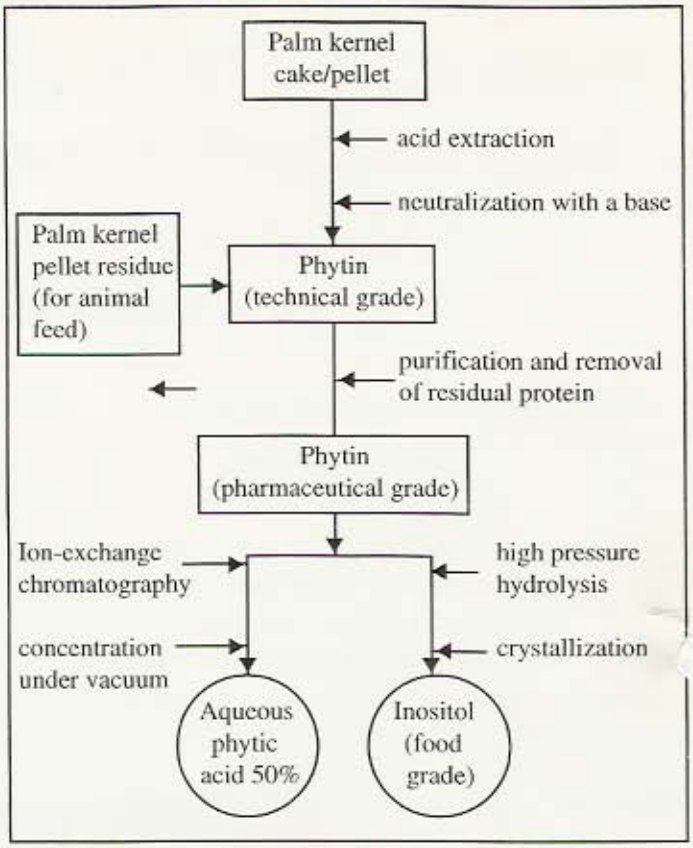

Figure 2. Flowchart for producting phytin (two grades), phytic acid and inositol from palm kernel cake.

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